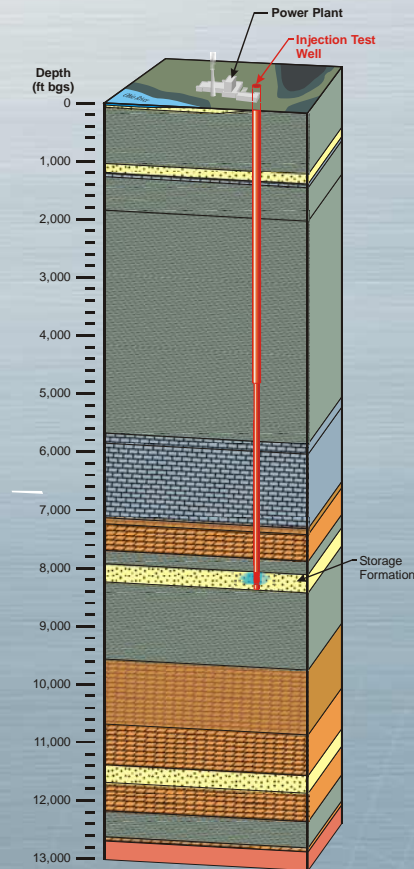


Battelle

The Business of Innovation



MRCSP R.E. Burger Site

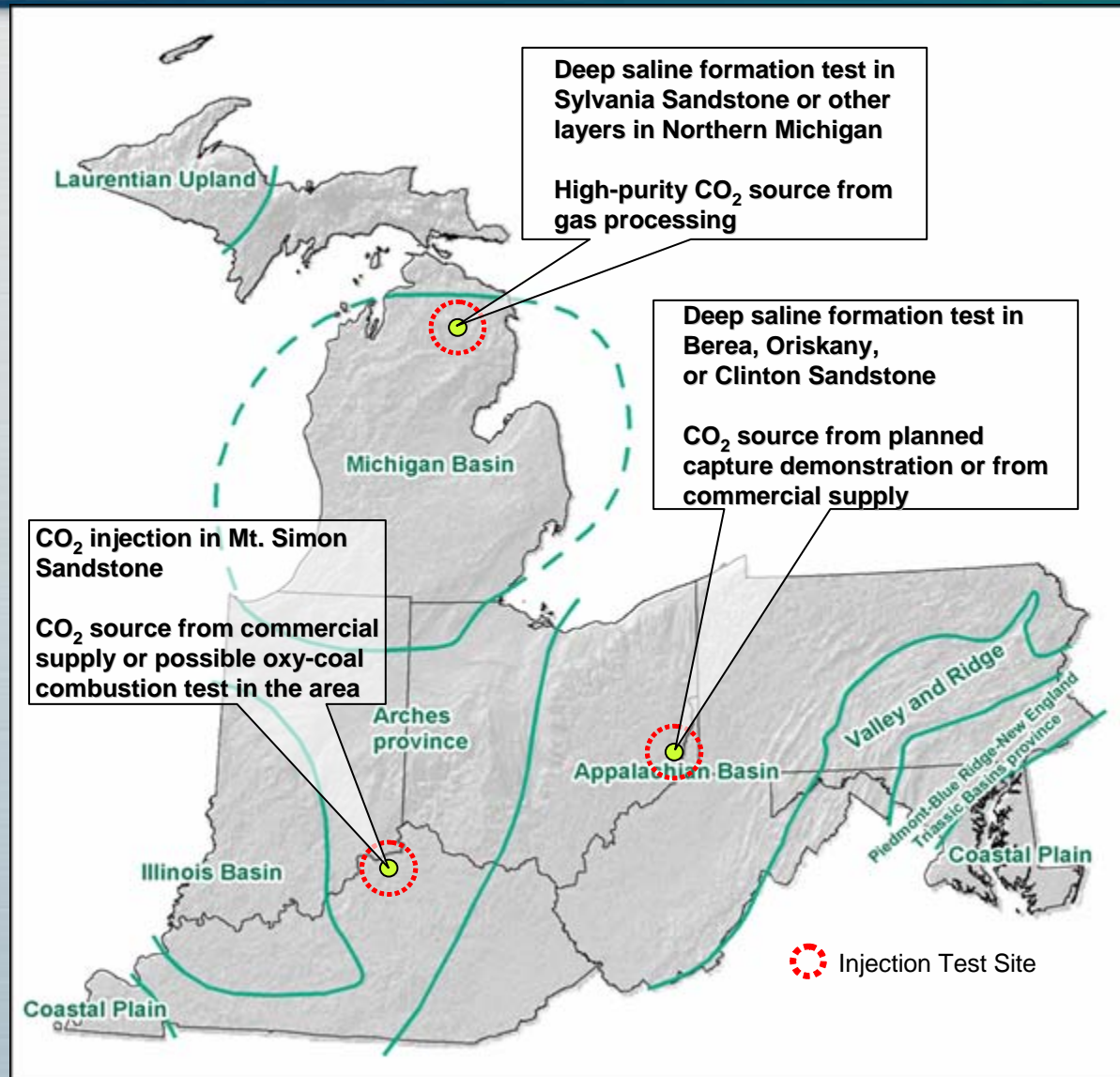
Geologic Field Tests in the Appalachian Basin



Presented By: Neeraj Gupta, Battelle
DOE/NETL Regional Partnership Annual Meeting
October 3-4, 2006, Pittsburgh, PA



MRCSP Geologic Field Tests



R.E. Burger Field Test Core Team



Michele Somerday and others



Larry Wickstrom, Ernie Slucher, Mark Baranoski



Dave Ball, Neeraj Gupta, Phil Jagucki, Joel Sminchak, Danielle Meggyesy, Judith Bradbury, Bob Janosy, Jackie Gerst, Diana Bacon



Charlie Byrer



Lee Avary

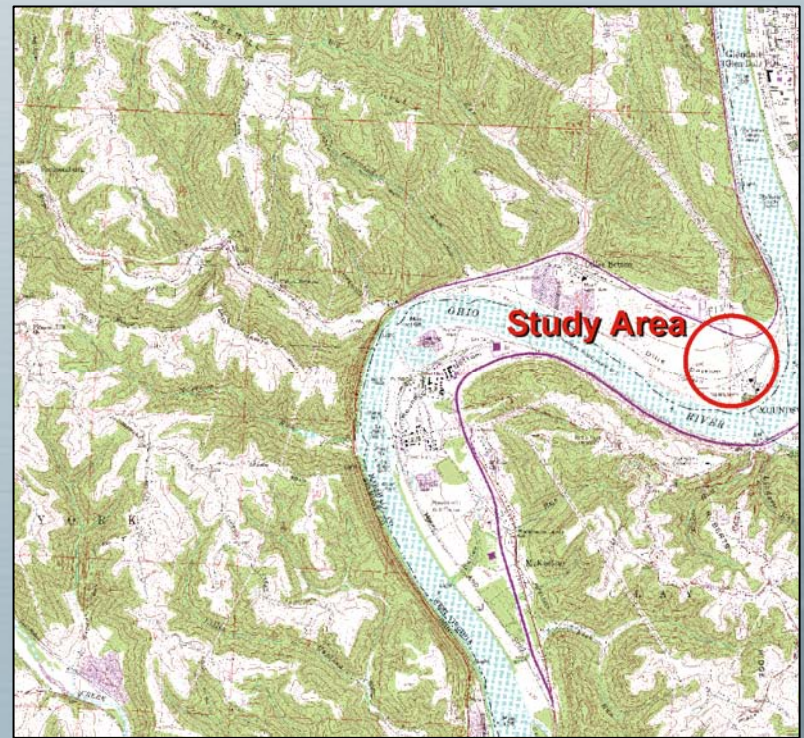
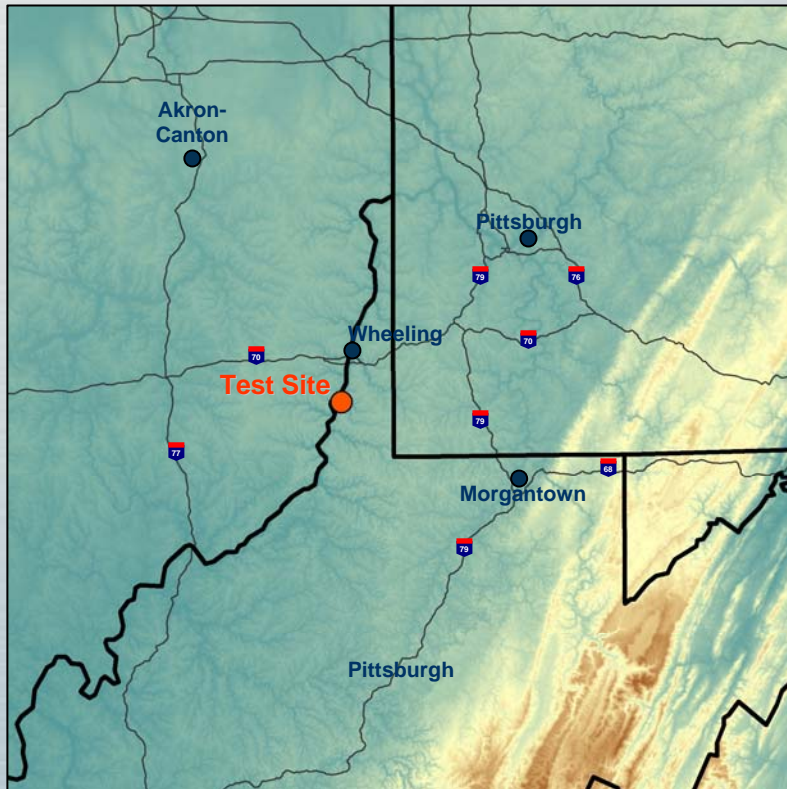


John Harper, Kristin Carter

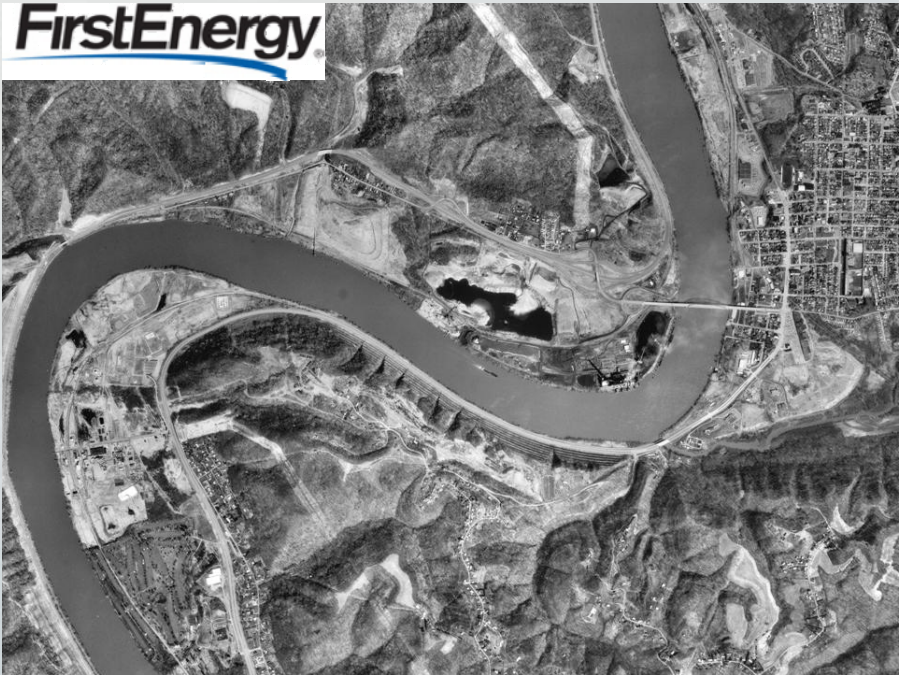
Additional Contributions by Numerous Other MRCSP Team Members

Appalachian Basin- R.E. Burger Test Site

- FirstEnergy Plant outside of Shadyside, Ohio
- 30 miles southwest of Wheeling, West Virginia
- Near Maryland, Ohio, Pennsylvania, and West Virginia

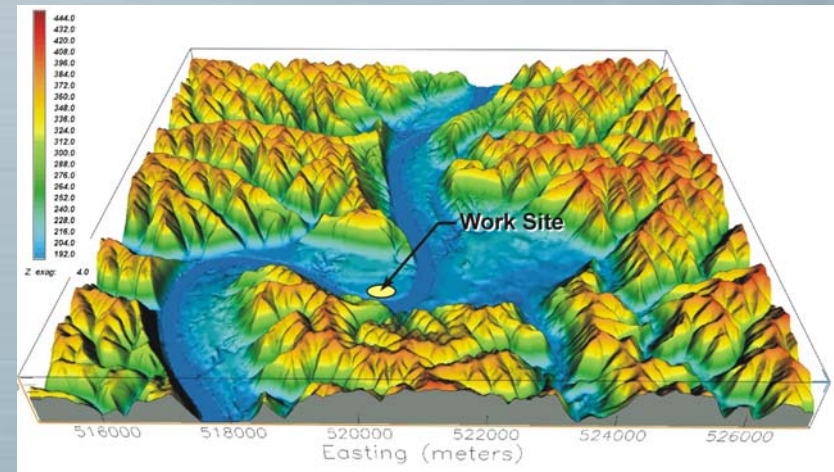


R.E. Burger Test Site



- FirstEnergy R.E. Burger facility
- 413 MW coal-burning power plant

- 100 acres on the floodplain along a bend in the Ohio River



R.E. Burger Test Site

- The plant is an industrial setting, with various generating buildings, coal staging areas, and other facilities.
- The site is located at an active plant which is providing property access for the field work and other support that should aid in completing the project.



East Bend Test Site- Public Outreach

- Solidified working team for each geologic pilot consisting of staff from host company and MRCSP
- Planned outreach according to planned seismic survey and injection testing
- Developed a series of site-specific fact sheets, video clips, briefing materials for each geologic field test
- Ensured that state and local officials and nearby residents received notice about the planned pilot and seismic survey (if applicable) in person, via letter or telephone call

R.E. Burger Test Site: Outreach

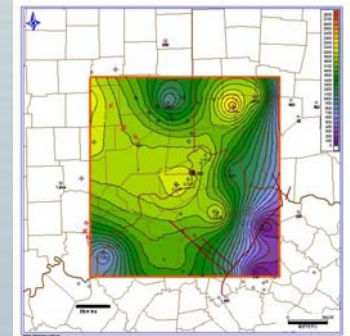


- Coordinated with FirstEnergy in identifying, scheduling and providing technical assistance in interactions with employees, officials and nearby residents prior to beginning seismic survey in July
- Developed a series of information materials tailored to the various stakeholders (neighbor letter, fact sheet, briefing materials)
- Completed a video of the seismic survey — to be made available as part of an ongoing “Project Snapshot” section of the website
- Now beginning planning for drilling subsequent project phases

Phase II: Geologic Field Test Plans

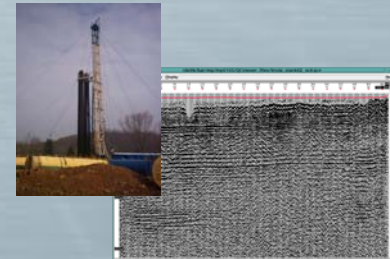
Preliminary Geologic Assessment

- **Site specific assessment of target storage reservoirs and geologic setting.**
- **Performed by state Geologic Surveys.**



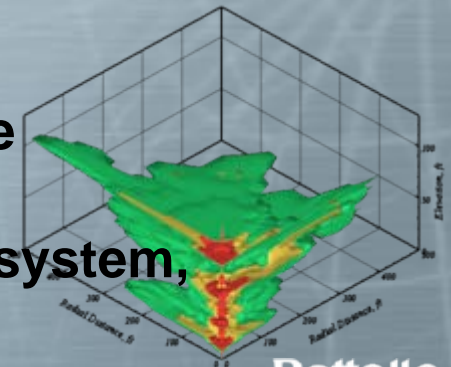
Site Characterization/Field Work

- **Seismic surveys, test-well drilling, reservoir tests, brine sampling, other field work at the demo sites.**
- **Site characterization data will be used to design injection well and monitoring programs.**



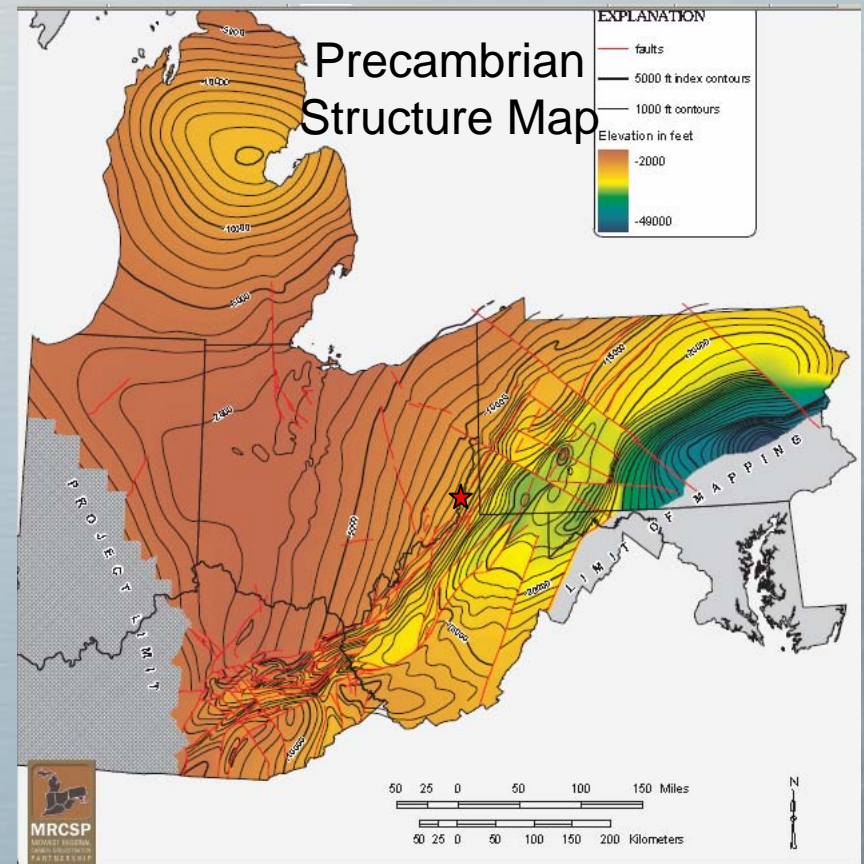
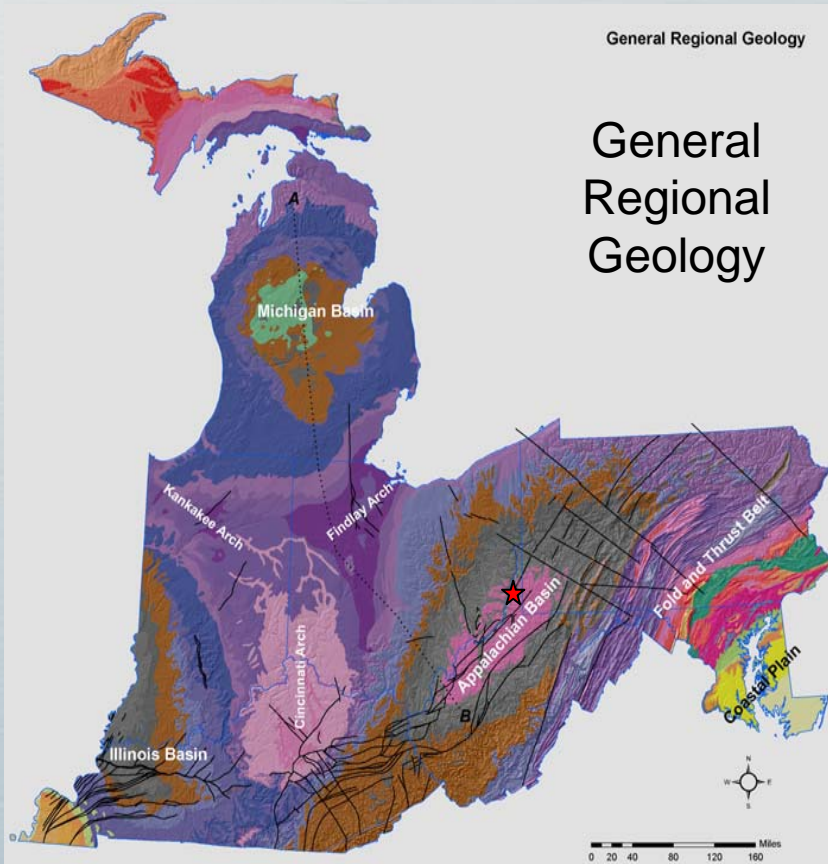
CO₂ Injection Tests and Monitoring

- **CO₂ injection testing and monitoring/verification.**
- **Objectives vary by location due to different storage targets, CO₂ sources, and system design.**
- **Monitoring will be completed to evaluate injection system, CO₂ migration, and health & safety.**



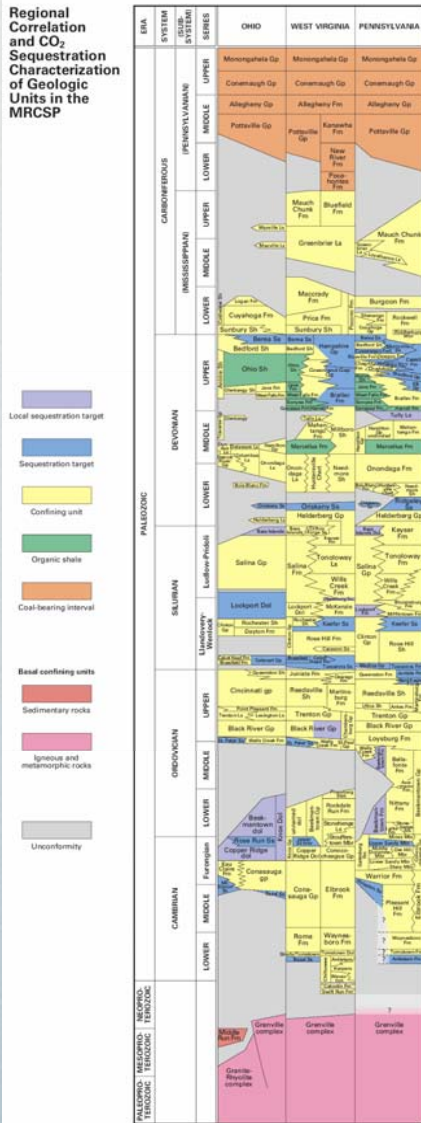
Geologic Setting- Appalachian Basin

- Preliminary geological assessment completed by Ohio Geological Survey with West Virginia and Pennsylvania Geological Surveys



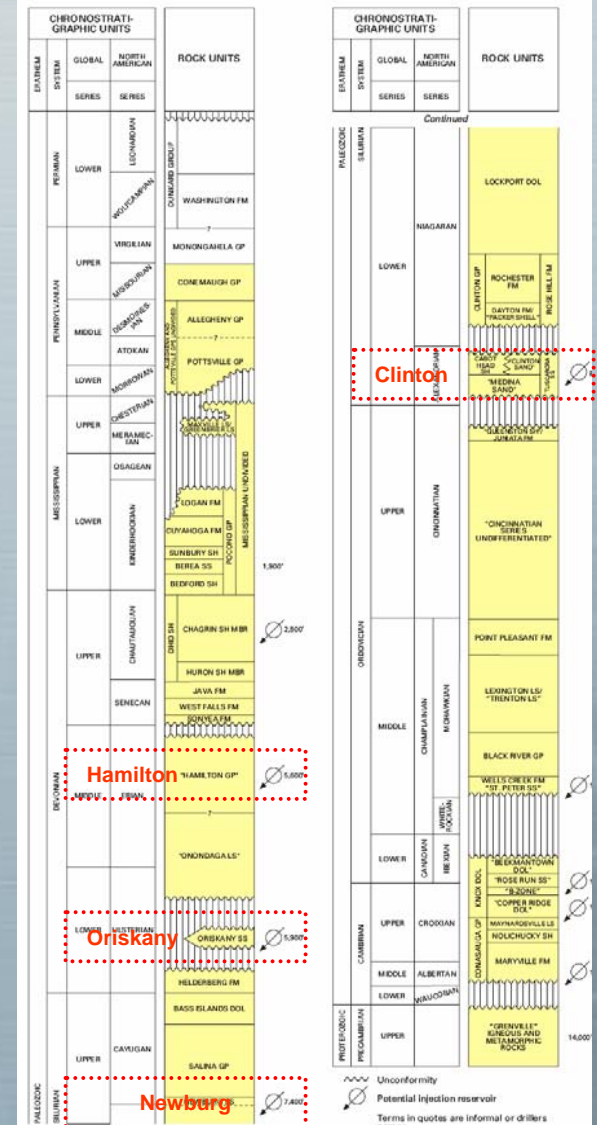
Appalachian Basin Stratigraphy

Regional
Correlation
and CO₂
Sequestration
Characterization
of Geologic
Units in the
MRCS



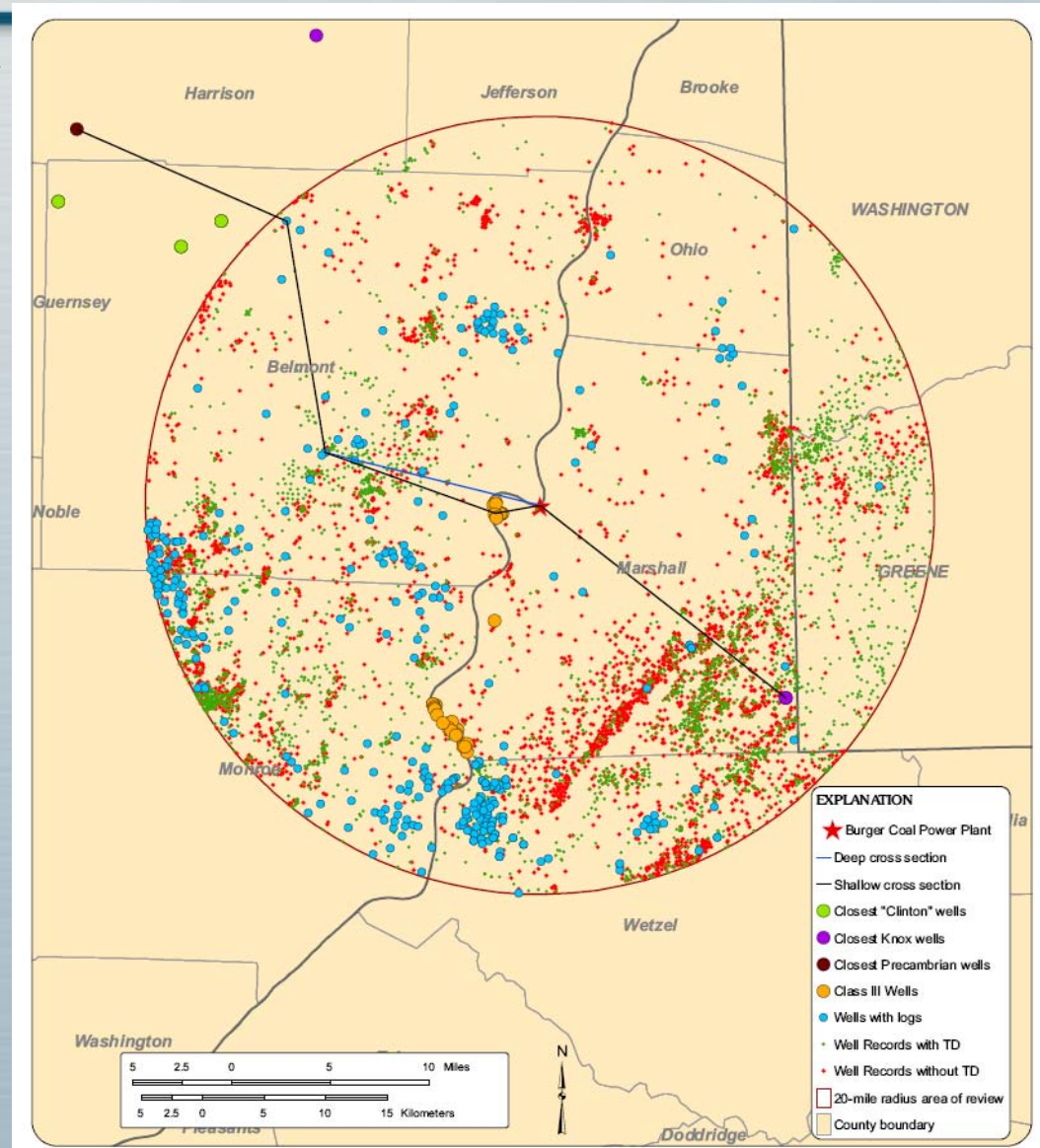
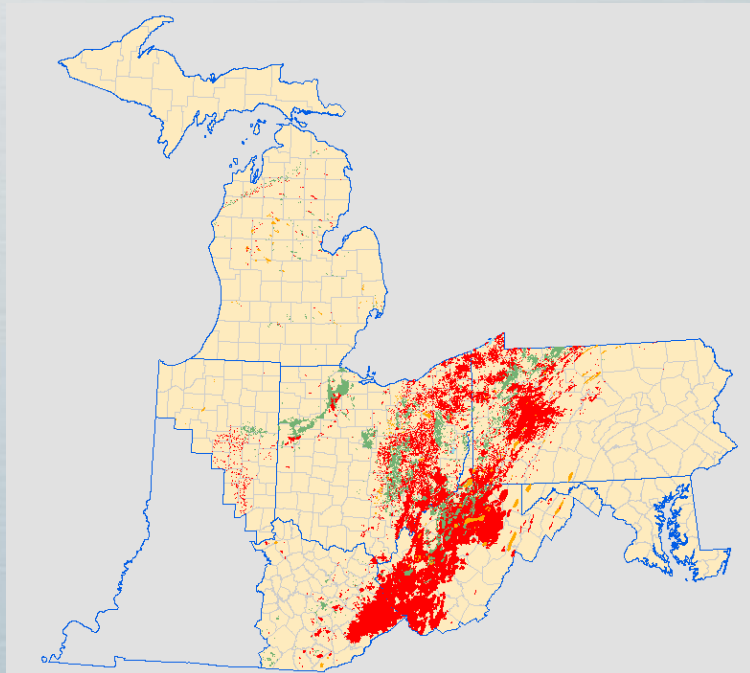
•Regional Stratigraphic nomenclature in the study region

•Preliminary targets include Hamilton Group, Newburg, and Oriskany and “Clinton” sandstones

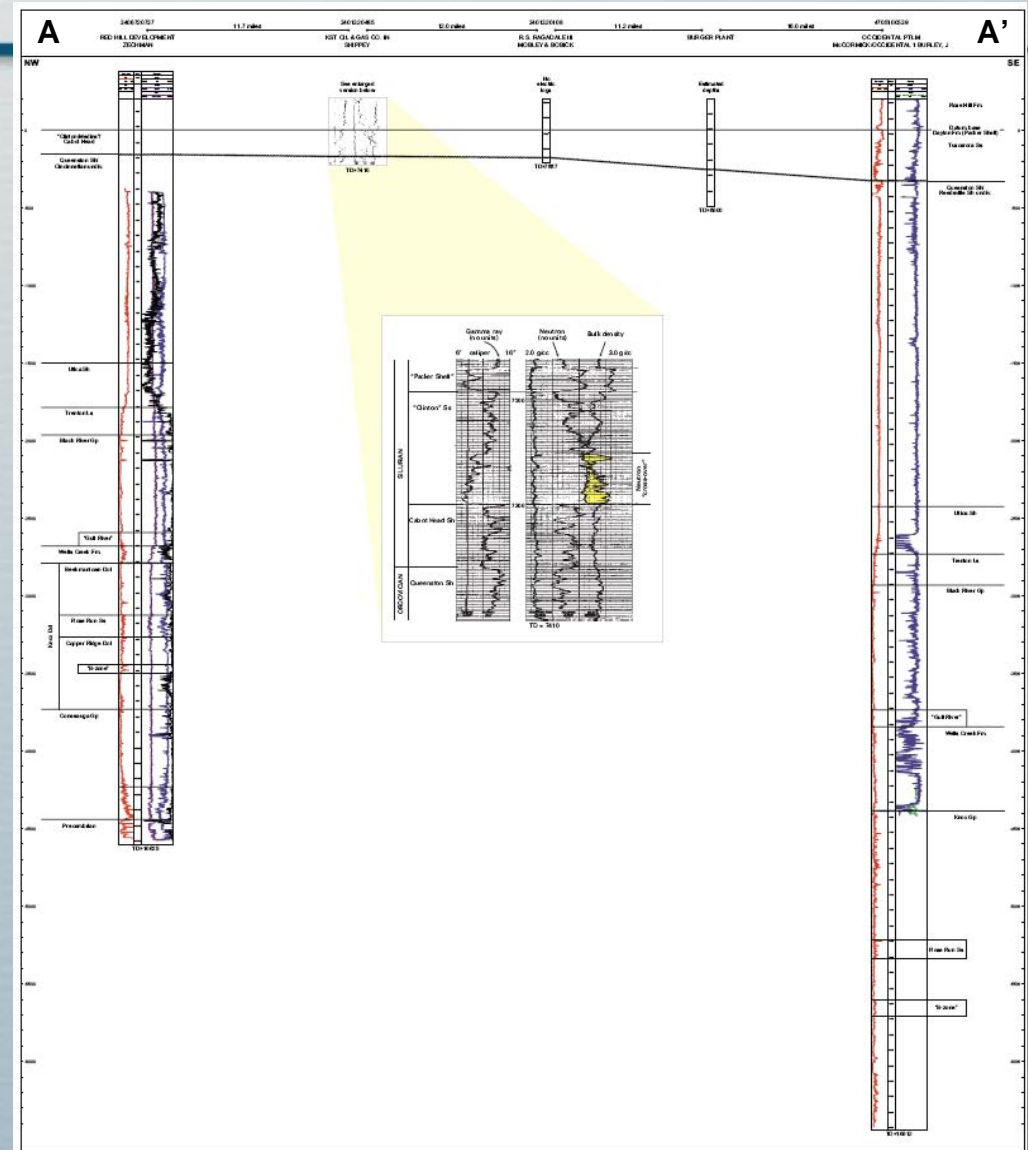


Geologic Setting- Oil and Gas Fields

- Minor oil and gas exploration near the study site.
- Most nearby wells are older wells less than 1,000 ft deep

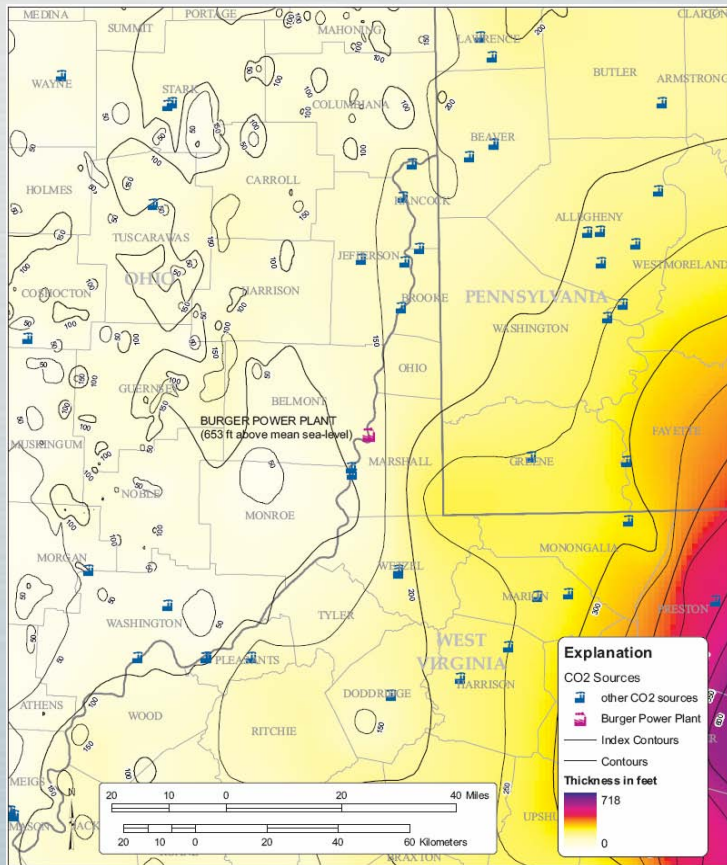


- Poor well control.
- Nearest deep wells are more than 5 miles from site.



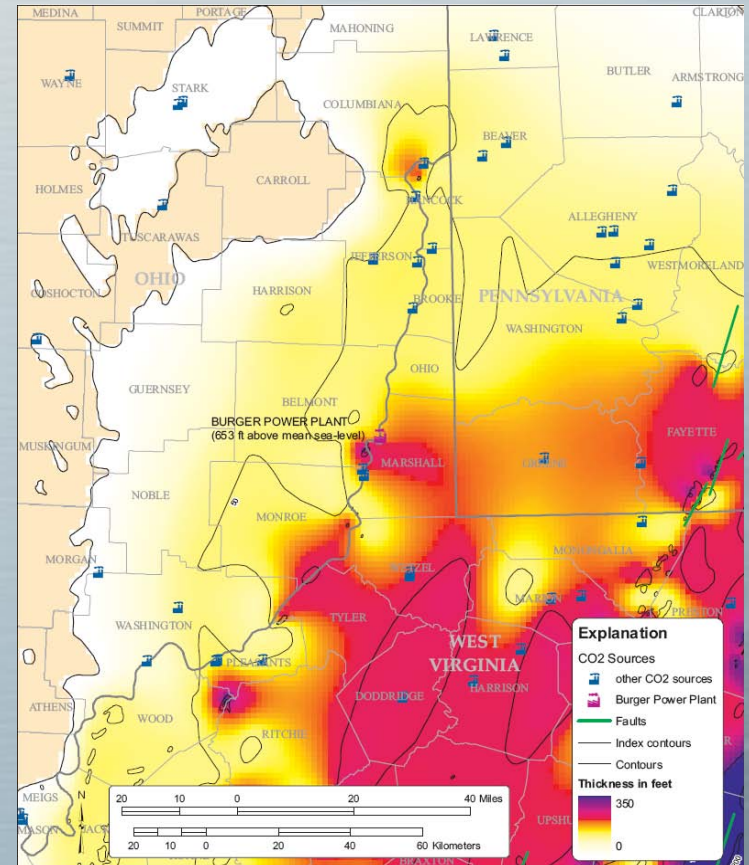
Maps of Target Formations

Tuscarora/Clinton Sandstone Thickness Map



Estimated at ~125 ft thick at Site
Hydraulic properties uncertain

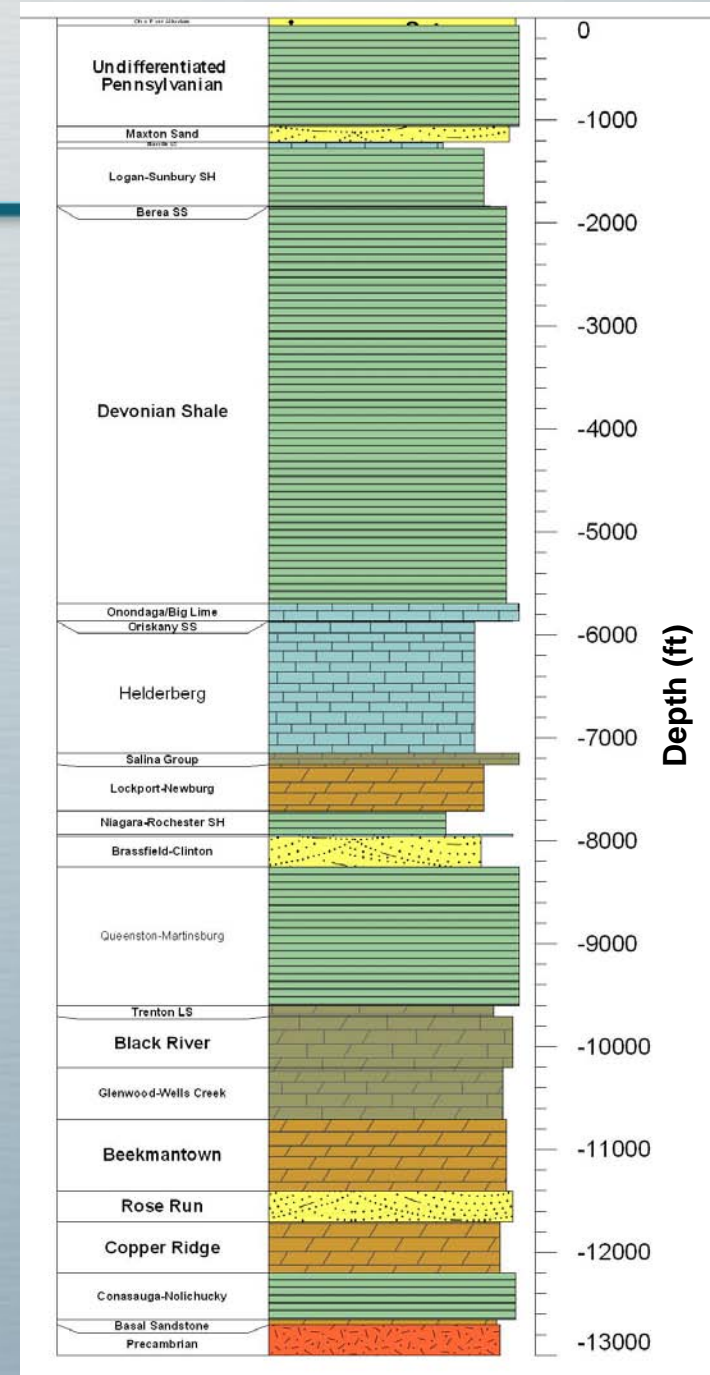
Oriskany Sandstone Thickness Map



More variable in thickness
near site

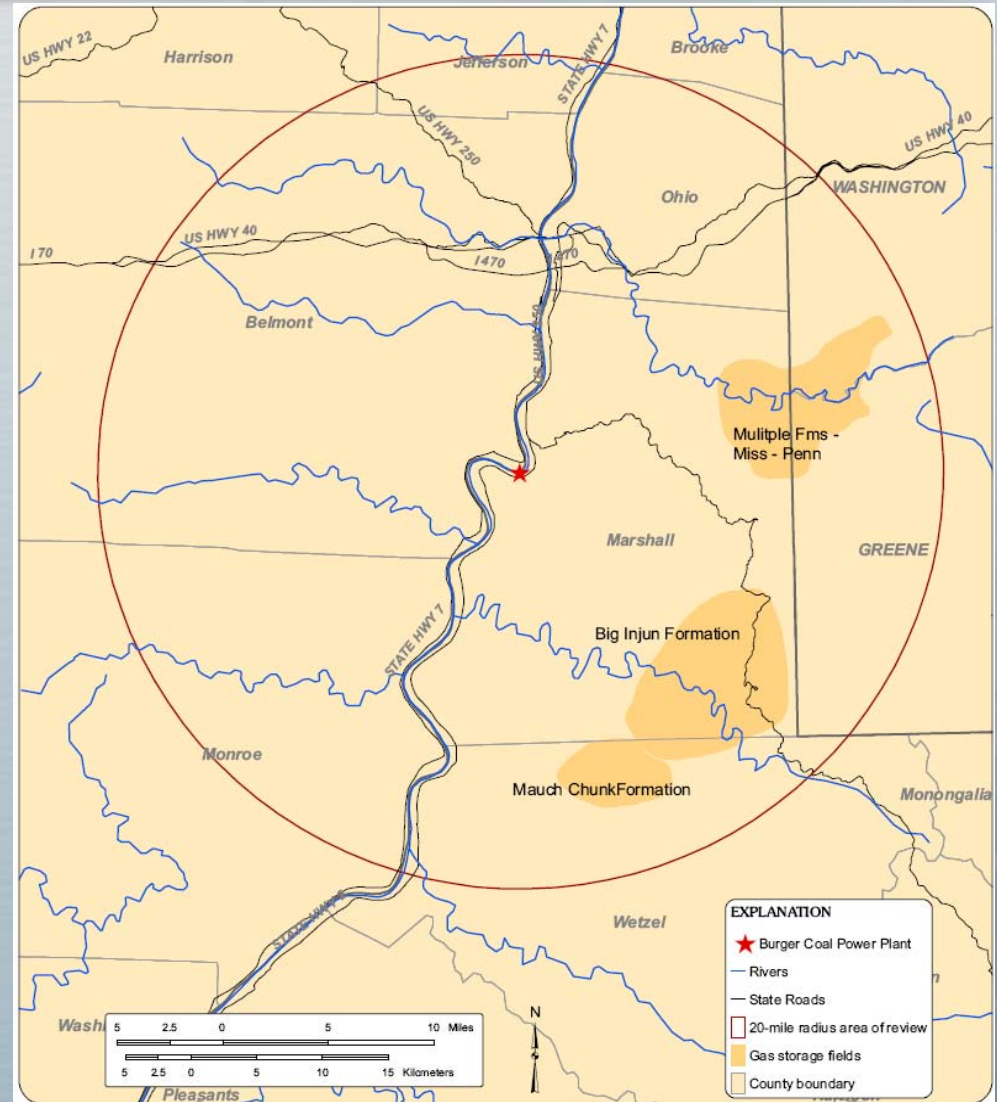
Preliminary Geology Prognosis

- Sedimentary rocks ~13,000 ft deep and overlie Precambrian bedrock.
- Primary targets include Hamilton Group, Oriskany Sandstone, and Tuscarora/"Clinton" sandstone
- Very few wells this deep in the region; therefore, this site is exploratory in nature



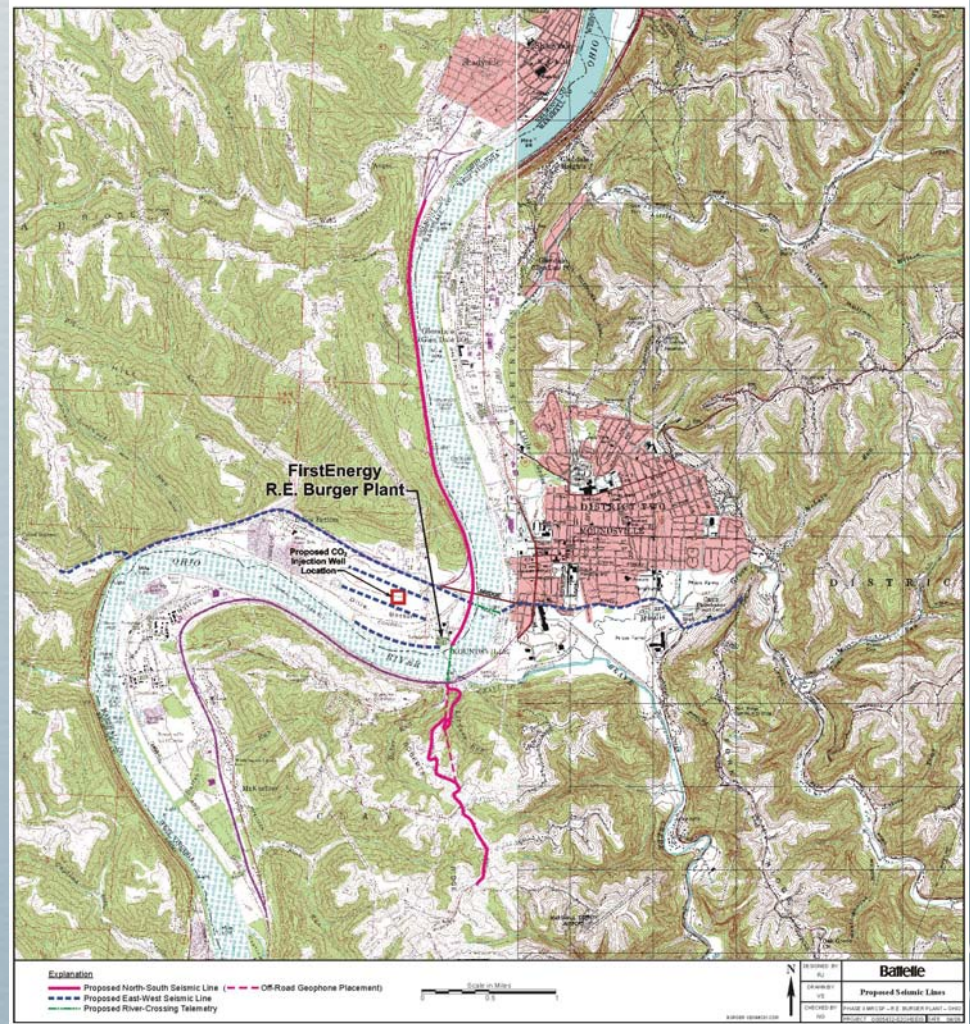
Preliminary Geology

- History of gas storage in this region.
- Most gas storage in shallower fields (Mississippian-Pennsylvanian)



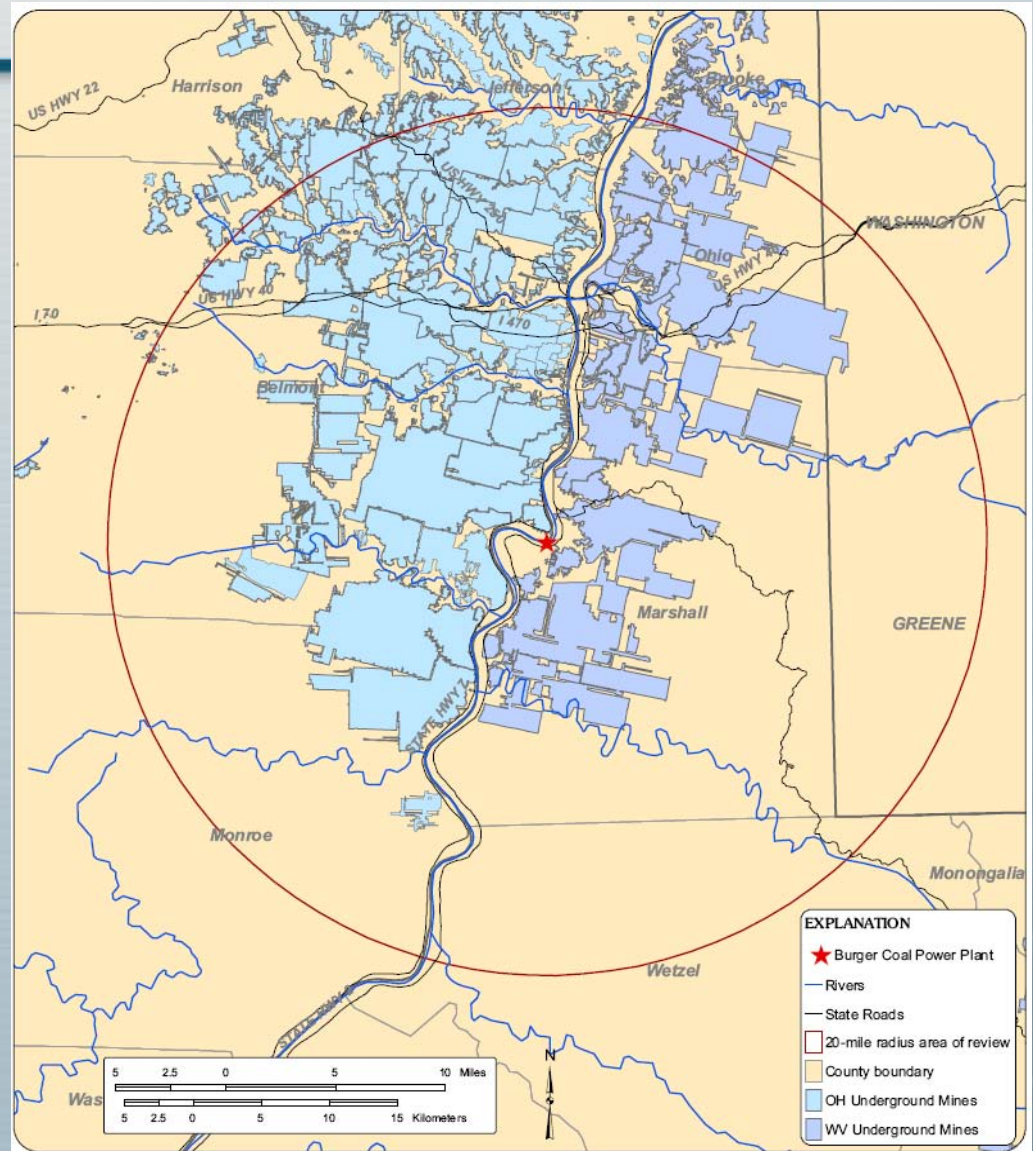
Seismic Survey

- 10-mile seismic survey completed in August 2006
- Additional 1-mile of “quasi-3D” to investigate reservoirs and 3D options



Seismic Survey

- Numerous underground coal mines in the area presented challenges in routing seismic survey.

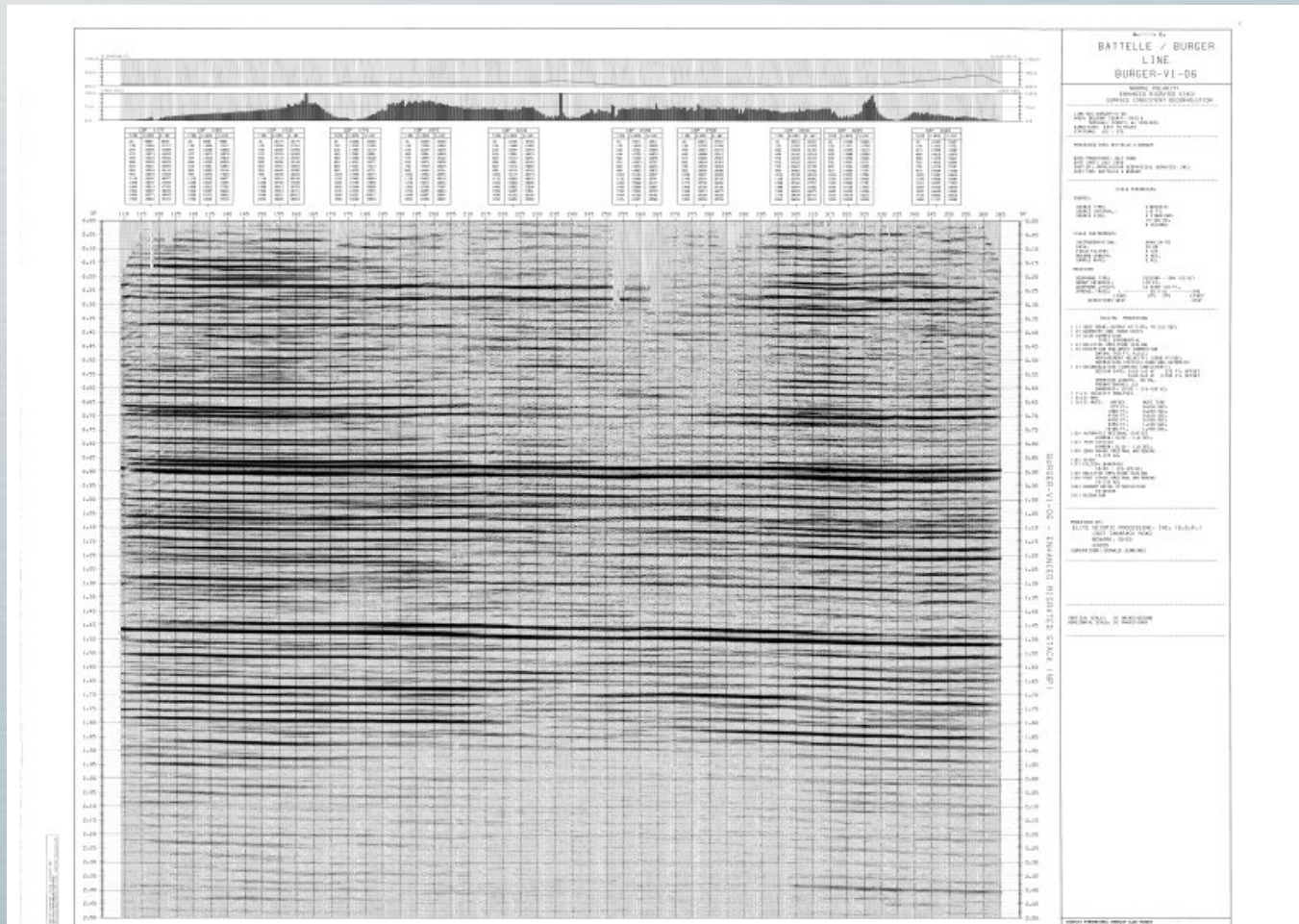


Regulatory Track

- Ohio has UIC Primacy and Ohio EPA regulates Class I and Class V wells. Ohio Department of Natural Resources regulates oil/gas wells and Class II wells
- Several meetings have been held with both regulatory agencies to discuss the project and permitting strategy
- FirstEnergy has been part of all discussions and Battelle and FirstEnergy are jointly preparing the permit documents
- Initially, a Stratigraphic test permit from ODNR will be used for drilling and later converted to injection permit. Initial permit has been completed and undergoing final review
- Issues:
 - Well construction requirements
 - CO₂ stream characterization (not required if commercial CO₂)
 - Need for additional public meetings?

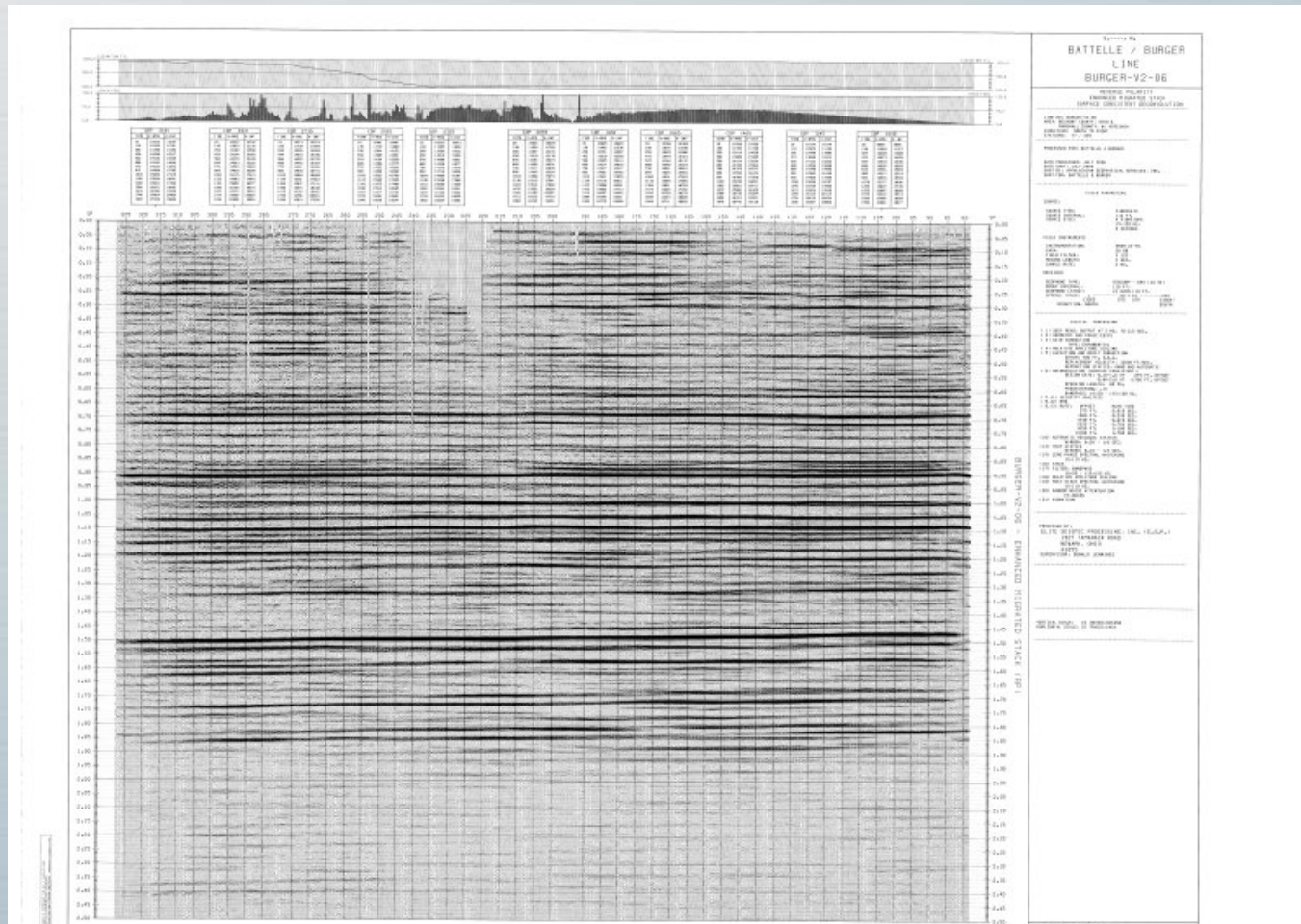
Seismic Survey- Preliminary Data

- Nearly flat, continuous layers, no indication of structure
- Strong reflectors at Big Lime and Trenton



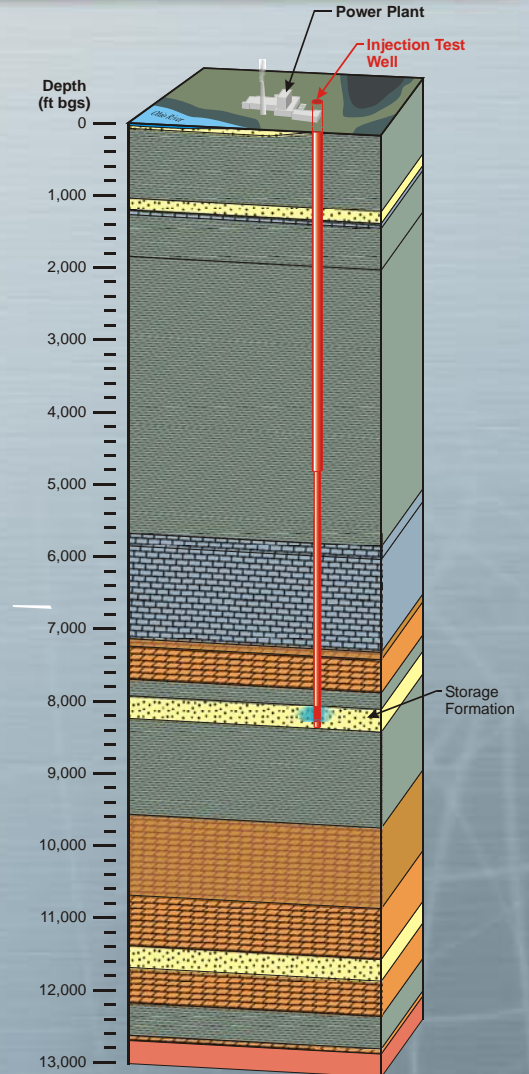
Seismic Survey

- Some data quality loss across Ohio River floodplain



Preliminary Conceptual Injection System

- Middle-Devonian to Middle Silurian deep saline formations primary target (Hamilton Group, Newburg, Oriskany and “Clinton” sandstones)
- Very extensive shale and carbonate containment layers
- Well construction specifications under development



CO₂ Source

- If feasible, CO₂ may be obtained from PowerSpan pilot-scale emission control system at the site.
- This would provide an opportunity to test an integrated CO₂ capture, handling, and injection system in this tri-state area of the Appalachian Basin.



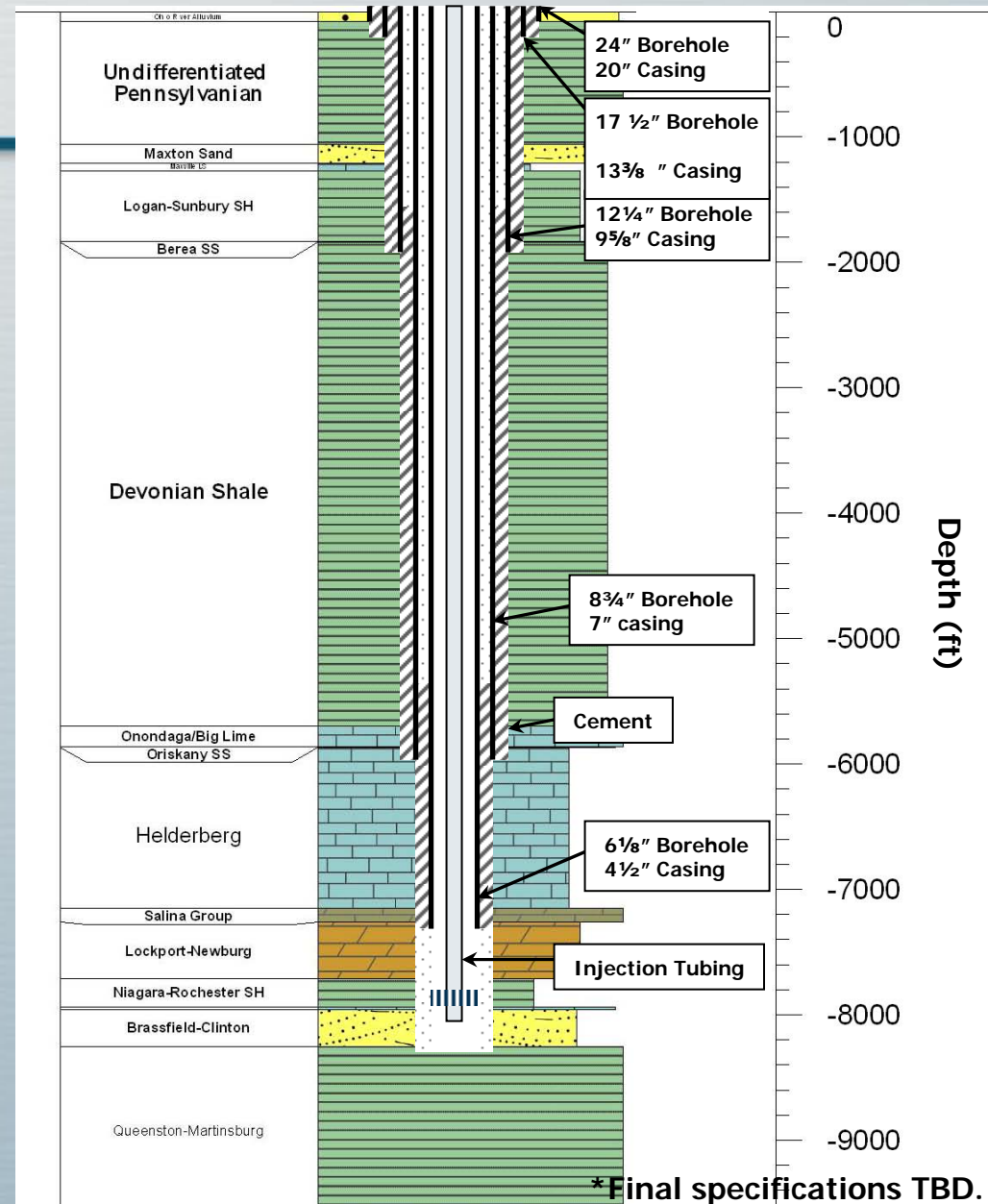
MMV – To be Finalized

- Monitoring options were reviewed and a subset of options was selected based on the proposed injection system specifications and geologic setting.
- Complete monitoring plan and schedule will be determined after site characterization efforts are finished.
- Depth of target reservoir presents challenges for effective MMV methods.

Appalachian Basin									
Time (Months)	-6	-4	-2	1	2	3	2	4	6
Phase	Pre-demo			Active Injection			Post-Injection		
Injection System (PVT)				X	X	X			
Health and Safety (O ₂)				X	X	X			
Wireline (CMR, Nuetron/RST, PEX)			X		X		X		
Reservoir Sampling???			X				X		
Tracer/Geochemical			X				X		

Injection System Design

- The overall plan for the R.E. Burger site is to perform a fairly thorough site characterization and integrate injection testing with the Powerspan process, if possible; otherwise CO₂ will be obtained from regional source(s).



Timeline and Next Steps for the Appalachian Basin R.E. Burger Test Site

- Seismic Survey (completed)
- Site characterization (in progress)
- Permitting (in progress)
- Test Well Drilling (driller scheduled for Nov-Dec time slot)
- System Design and installation
- Injection testing and monitoring
- Post injection and closure